REMARKS

Claims 1 and 7 have been amended. Claims 1-8 are pending. The specification has been amended to correct a minor typographical error. No new matter was introduced.

Claims 1, 4-6 and 8 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 7,106,895 to Goldberg et al. ("Goldberg"). Claim 7 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Goldberg in view of Kuwabara. The rejections are respectfully traversed.

Claim 1 as amended recites that "said forward end overlap is the sum of an overlap margin for operation processing and the maximum cell pitch of a plurality of cell pitches in cell to cell comparison inspection, and said rear end overlap is an overlap margin for operation processing." This amendment is supported by Fig. 15 and the following portions of the specification.

On page 11, lines 21-23, "The forward end overlap OF is the sum of an overlap margin for operation processing and a cell pitch size, and the rear end overlap OR is an overlap margin for operation processing."

On page 27, the bottom line to page 28, line 2, "In this case, the length of the forward end overlap OF of a cutout image is determined by the maximum cell pitch in a chip."

On page 28, lines 9-12, "In this embodiment, the maximum cell pitch size throughout the chip is obtained before inspection. During inspection, by cutting out all the image data with the overlap OF, high operation can be performed."

Amended claim 7 recites that "said forward end overlap is the sum of an overlap margin for operation processing and the double of a cell pitch size in cell to cell comparison inspection, and said rear end overlap is the sum of an overlap margin for operation processing and the cell pitch size." This amendment is supported by Fig. 16 and the specification, on page 28, the bottom line to page

29, line 3, which reads "The forward end overlap OF is the sum of an overlap margin for operation processing and the double of a cell pitch size and the rear end overlap OR is the sum of an overlap margin for operation processing and the cell pitch size."

The image processing apparatus of the present invention is applied to perform visual inspection by die to die comparison and cell to cell comparison. In some cases circuitry patterns of chips produced on a semiconductor wafer are identical and repeated, while in other cases identical repeated circuitry patterns are produced on a chip. A die to die comparison inspection system is configured to compare neighboring chips in grid arrangement on the wafer 1702, as shown e.g., in FIG. 18A. On the other hand, the cell to cell comparison inspection system is configured to compare the repeated patterns which are called cells, like memory mats in one chip, as shown in FIG. 18B.

As described in the present application, if the cell to cell comparison inspection is performed by using the image processing apparatus, which is applied to perform visual inspection by die to die comparison and cell to cell comparison, a problem occurs. Specifically, the problem is described at page 6, lines 10-18 as follows: "Besides the inspection image, a reference image of the cell preceding the inspection cell is necessary in cell to cell comparison inspection. However, if, for example, the image of a cell to be inspected is positioned at the beginning of unit image data D2 which is processed by the processor element PE (1) in FIG. 21, the image of the preceding cell as the reference image does not exist in the data D2 and it becomes impossible to inspect this cell. Like this, image data distribution generates such an area that it is impossible to perform cell to cell comparison inspection."

The object of the present invention is to avoid such an area that it is impossible to perform cell to cell comparison inspection.

According to the basic concept of the present invention, as shown in Fig. 3, the length "W" of cutout image with respect to the unit image data Dn is the sum of: forward end overlap OF + unit image data Dn + rear end overlap OR. The forward end overlap OF is the sum of an overlap margin

for operation processing and a cell pitch size, and the rear end overlap OR is an overlap margin for operation processing, as described in the specification, on page 11, lines 21-23 and in Fig. 11. In order to perform the cell to cell comparison inspection for cells in unit image data Dn (in a chip), it is necessary that the forward end overlap OF includes at least one cell pitch size in addition to an overlap margin for operation processing, as shown in Fig 11.

According to claim 1, the forward end overlap includes the maximum cell pitch of a plurality of cell pitches in addition to an overlap margin for operation processing. According claim 7, the forward end overlap includes the double of a cell pitch size in addition to an overlap margin for operation processing.

In the example of Fig. 11, the cell pitch sizes are equal to one another in all unit image data. However, in some cases, the cell pitch sizes are not equal to one another in all unit image data, as shown in Fig. 15.

In the example shown in Fig. 15, the cell pitch of cell 1501 in unit image data D2 is larger than the cell pitch of cell 1502 in unit image data D3. Therefore, if the length of the forward end overlap OF of a cutout image 1503 is determined by the smaller cell pitch of cell 1502, the forward end overlap OF of cutout image 1503 with respect to unit image data D2 cannot include a full cell pitch of cell 1501, and therefore, it is possible to perform the cell to cell comparison inspection for cells in unit image data D2.

According to claim 1, the forward end overlap is the sum of an overlap margin for operation processing and the maximum cell pitch of a plurality of cell pitches in cell to cell comparison inspection, and the rear end overlap is an overlap margin for operation processing.

By determining the length of the forward end overlap OF of a cutout image based on the maximum cell pitch in a chip, it ensures that the forward end overlap OF of a cutout image can include at least one cell pitch size in addition to an overlap margin for operation processing.

Therefore, the cell to cell comparison inspection can be performed for cells in unit image data, though the cell pitch sizes are not equal to one another in all unit image data.

As shown in Fig. 16, an inspection effective region "A" is equal to a unit image for inspection, and therefore, the cells 2 and 6 on the boundaries between the unit images cannot be inspected.

According to claim 7, the forward end overlap is the sum of an overlap margin for operation processing and the double of a cell pitch size in cell to cell comparison inspection, and the rear end overlap is the sum of an overlap margin for operation processing and the cell pitch size. By determining the forward end overlap to be the sum of an overlap margin for operation processing and the double of a cell pitch size in cell to cell comparison inspection, the inspection effective region "B" can be extended relative to unit image for inspection.

By extending the inspection effective region from "A" to "B" it is possible to perform the cell to cell comparison inspection not only for cells in unit image data but also for cells on the boundaries between the unit images.

Goldberg column 8, lines 42-48 reads as follows: "Alternatively, the reference data may be an image corresponding to a patch of the sample that is within a die adjacent to the die of the patch under test. This is commonly referred to as a die-to-die analysis. In other words, images corresponding to two adjacent die patches are analyzed in conjunction by a leaf processor. The present invention may also be implemented for cell-to-cell comparisons."

Goldberg discloses die-to-die analysis or cell-to-cell comparisons, but does not teach an image processing apparatus for wafer inspection tool to perform visual inspection by die to die comparison and cell to cell comparison as recited by claim 1: "wafer inspection tool to perform visual inspection by die to die comparison and cell to cell comparison." Goldberg does not identify such a problem as an area that upon which it is impossible to perform cell to cell comparison inspection. Goldberg column 7, lines 21-24 reads as follows: "As shown, there is an overlap area 210c between

images 202 and 204, an overlap area 210b between images 204 and 206, and an overlap area 210a between images 206 and 208."

Further, Goldberg teaches a purpose and effect of an overlap area in column 7, lines 25-33, but the purpose and the effect of overlap area of Goldberg is different from that of the present invention.

According to the present invention, the forward end overlap is determined based on cell pitch size. Particularly, the forward end overlap OF includes at least one cell pitch size in addition to an overlap margin for operation processing.

According to claim 1, the forward end overlap includes the maximum cell pitch of a plurality of cell pitches in addition to an overlap margin for operation processing. According to claim 7, the forward end overlap includes the double of a cell pitch size in addition to an overlap margin for operation processing.

Goldberg does not teach that the forward end overlap is determined based on cell pitch size. Goldberg does not teach that the forward end overlap includes at least one cell pitch size in addition to an overlap margin for operation processing. Goldberg does not teach that the forward end overlap includes the maximum cell pitch of a plurality of cell pitches in addition to an overlap margin for operation processing. Goldberg does not teach that the forward end overlap includes the double of a cell pitch size in addition to an overlap margin for operation processing.

Accordingly, claims 1, 4-6 and 8 are allowable over Goldberg. Claim 7 is allowable over the Goldberg and Kuwabara combination, since Kuwabara does not cure Goldberg's deficiencies.

Accordingly, the rejections should be withdrawn.

In view of the above, Applicants believe the pending application is in condition for allowance.

Dated: January 11, 2008

Respectfully submitted,

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